

**THE EFFECTS OF NEARBY CLUSTERS OF GALAXIES ON THE
MICROWAVE BACKGROUND RADIATION**

NASA Grant NAG5-2415

Annual Report No. 2

For the Period 15 November 1994 through 14 November 1995

Principal Investigator
Dr. M. Birkinshaw

April 1996

Prepared for:

National Aeronautics and Space Administration
Goddard Space Flight Center
Greenbelt, Maryland 20771

Smithsonian Institution
Astrophysical Observatory
Cambridge, Massachusetts 02138

The Smithsonian Astrophysical Observatory
is a member of the
Harvard-Smithsonian Center for Astrophysics

The NASA Technical Officer for this grant is Dr. Donald West, Code 684.1, Laboratory for Astronomy and Solar Physics, Space Sciences Directorate, NASA/Goddard Space Flight Center, Greenbelt, MD 20771

After extensive testing of the quality of the data and the codes, some results from the comparison of the HEAO-A2 and COBE data are now available.

The major emphasis of our first detailed analysis is on the Shapley Supercluster (SSC), a region which contains a large overdensity of clusters and for which diffuse gas might be found on scales exceeding 10 Mpc. Not only is there some excess X-ray emission associated with the SSC, but there appears also to be a microwave background structure in this region. The analysis of the structure, which may be associated with the Sunyaev-Zel'dovich or Rees-Sciama effects which are the major aims of this work, is complicated by underlying primordial fluctuations in the background radiation and proximity to the Galactic plane. Statistical analysis of this structure suggests a modest level of significance (2 - 3 sigma), unless the central point in the cluster is excluded, when the significance drops dramatically.

As a control on the reality of the effect, similar analyses are being made on adjacent regions of blank sky. If a large fraction of these regions shows structures of similar apparent significance, then the effect that we seem to be finding is likely to be produced by chance.

Nevertheless, if it is real the microwave background radiation structure has interesting implications for the temperature, density, and extent of supercluster gas (on the Sunyaev-Zel'dovich effect interpretation), and on the mass of the region (on the Rees-Sciama effect interpretation).

Much work at present is concentrated on the statistical checks, but a paper on the signal is being drafted (Molnar and Birkinshaw 1996) and the scientific interpretation is under study.

When we are sure that the SSC is understood, the same code and techniques will be applied to the other prominent objects in which we feel that there is a chance of detecting the Sunyaev-Zel'dovich or Rees-Sciama effects (listed in the original proposal).

